GAS JOURNAL

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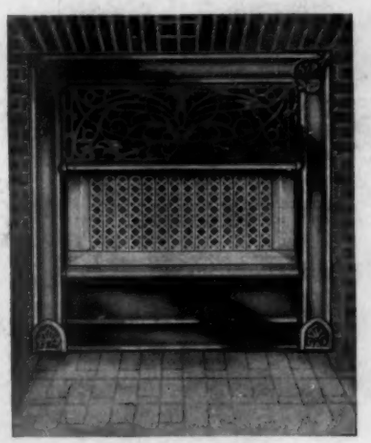

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American Gas Journal

SIXTY-FIFTH YEAR

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"MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS"

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AMERICAN
GAS JOURNAL

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"Let's Get Down to Business"

An industrial gas research foundation is advocated

C. H. Light

Industrial Gas Engineer

THE main factors which we find at this time, limiting the more general application of gas as an industrial fuel, may be summarized as follows:

(1) *Cost.*
Due to the prevailing calorific standards required by law, and to manufacturing methods which must be improved in order to allow the utilization of the cheaper grades of fuel.

(2) *Utilization.*
Due primarily to the low thermal efficiency of furnaces, and secondarily to lack of knowledge of the "optimum" furnace design applicable to any specific operation.

The latter is by far the most important of these two. Although a great deal of attention has undoubtedly been given to this subject by manufacturers and gas companies all over the country, the lack of concentration on any specific problem has resulted in duplication of effort along certain minor lines, without any material or tangible gain to the fraternity as a whole along the major problems which confront us.

Standardized Equipment

The average furnace or equipment manufacturer frequently handles gas, oil and electric appliances. Obviously, he concentrates his efforts along more or less standardized lines, particularly those offering the greatest volume of sales. He cannot afford to spend time or money in the development of special equipment unless he is assured of a definite field in which similar appliances may be sold.

Electrical Competition

Without question, the most up and coming competition that gas companies must face today is electricity, not because it is an economic fuel from a national standpoint nor in general because its application results in lower unit cost of production, but because the fundamental laws of electricity are known. The electrical engineer is thoroughly familiar with these laws and as a result the electric furnace undoubtedly represents the most advanced practice in design and thermal efficiency known.

The vast resources of research and development that are available through companies like the General Electric Company and the Westinghouse Electric Company are a profound source of information to the industry. The results obtained are available to every furnace manufacturer and are disseminated to the engineering profession through post-graduate courses at these plants, the trade journals and technical publications.

Finally, the "magic" of electricity is broadcast to the public through every possible advertising medium, to the extent that a manufacturer points with pride to the fact that he makes "electric steel," etc., etc., etc.

Heat Losses

Let us see just what justification there is for the use of electricity in preference to gas. In any furnace the amount of heat actually utilized in useful work is governed primarily by the furnace design in that it limits heat losses as far as possible. These losses may be broadly summarized as follows:

(1) Unavailable heat in furnace lining.
(2) Radiation from furnace walls.
(3) Heat losses in products of combustion.

Gas Furnace—Not Restricted

Special gas furnaces have been built duplicating in every way the best principles of construction and design of the electric furnace. Thus, on gas and electric furnaces of comparable dimensions, the heat

losses due to items 1 and 2 will be equal. However, on small and medium size heat-treating equipment, the height of the working chamber in the electric furnace is governed to some extent by the size and capacity of the heating element. The gas furnace is not thus restricted and in general, for this class of equipment, the losses due to items 1 and 2 will be less in the gas furnace.

Products of Combustion

Under item No. 3 we come to a heat loss which applies only to fuel-fired furnaces. This loss consists of two parts:

(a) The latent heat in the water vapor, (H_2O), in the products of combustion, and

(b) The sensible heat or thermal capacity of the products of combustion at the temperature at which they leave the heating chamber.

combustion of an average city gas, and in Chart No. 2 these values have been used in determining the available B.t.u. and the percentage of heat losses at various temperatures. The analysis of the gas used as a basis for all of the data in the charts is as follows:

CO_2	5.4
Illuminants	8.6
O_2	.4
CO	28.6
H_2	29.3
CH_4	12.0
N_2	15.7

This gas has a B.t.u. value of 540.

Based on the assumption that the thermal efficiency (exclusive of flue gas losses) of a gas and an electric furnace are equal, and with the information given in charts 1 and 2 it is easy to calculate the

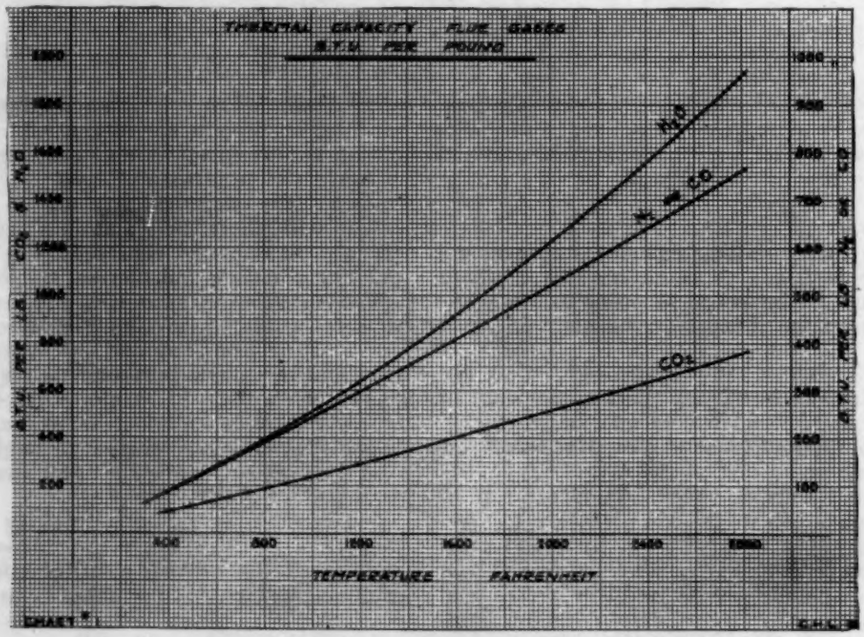


Fig. 1—Thermal Capacity of Gases

Heat Available

The available heat in any gas when applied to a heating operation can be calculated with reasonable accuracy by computing the products of combustion (preferably by weight) from the analysis of the original gas and multiplying each individual weight by its thermal capacity at the temperature of the gases leaving the heating chamber. To this must be added the latent heat in the water vapor, (H_2O). These losses added together and subtracted from the gross B.t.u. of the original gas will leave the available B.t.u.

Gas Analysis

Chart No. 1 indicates graphically the thermal capacity of gases normally found in the products of

equivalent volume of gas required to equal one KWH at various furnace temperatures. This has been done in chart No. 3. Under these same conditions, chart No. 4 indicates the net cost of gas per thousand cubic feet necessary to compare with electricity at various temperatures.

A Check

It is interesting to note that in a recent installation of two comparable furnaces where gas and electricity were in direct competition, the values given in chart No. 3 checked within 5 per cent. The installation was used for hardening at 1650 degrees F. The electric furnace required 150 KWH. to pro-

(Continued on page 172)

Decomposition of Anthracite Coal

Causes and determination of spontanious combustion and weathering

Dr. Fritz Hinden

(Considerable work has been done and much has been published on the question as to what happens when coal is stored. Does the coal decompose and is head value therefore lost in the process? It would appear that something of this sort does happen, and experiments undertaken by the Bureau of Mines and by private laboratories, particularly the large gas companies, have revealed the extent to which such losses are incurred in the storage of coal, both anthracite and bituminous. The article which follows, and which is translated from the Bulletin-Mensuel (Monats Bulletin), number 12, 1924, describes a series of experiments that were carried out on this subject in the gas works at the city of Zurich, Switzerland. These experiments dealt both with the weathering of coal and its decomposition and loss of heat values, and also with its spontaneous composition. By far the larger part of the article is concerned with a description of methods for the determination of the tendency of the coal to burn spontaneously. This is a rather interesting investigation and deserves the attention of the American gas engineer who is interested in the subject of the weathering of coal.—Trans.)

Certain anthracite coals, particularly those of more recent origin, when allowed to come in contact with air, decompose with the evolution of heat. When the heat is liberated slowly, because the reactions take place at a slow rate, the process is termed weathering of the coal, but when the rate of heat liberation is rapid, then spontaneous combustion of the coal ensues. In both cases the losses of heat values are considerable and are generally prevented by not permitting those coals that oxidize easily in the air to remain on the storage pile for any great length of time. Two examples of weathering and spontaneous combustion of coal will be cited below in brief.

Weathering of Coal

Samples of American hard coal, as well as of anthracites of other origin, were exposed to air in the laboratory. After a year's exposure the coal had disappeared and in its place was a light gray to snow white ash. Some pieces of coal seemed to be unacted upon and there were also observed numberous specs of pyrites. It seemed that only the American hard coal acted in this manner, the other samples remaining unchanged.

The American hard coal thus weathered and was decomposed into carbon dioxide, water vapor and sulphuric acid without any noticeable rise in the temperature, burning in the cold to produce a white ash.

Observation of a pile of American hard coal in the gas works was then made to see what happened therein and it was found that a part of the coal weathered and was oxidized to a grayish ash. The color of the coal was changed to grayish brown for a depth of twenty to thirty centimeters below the surface, but the coal at the depth of a meter in the pile was black brown and fresh.

Distillation Test of the Coal

A distillation of the coal was made to see what effect weathering had on the production of gas. A sample of coal from the surface and from the interior of the pile was tested. The results were as follows:

	1 meter deep	On the surface (20 centimeters deep)	Reduction of value of surface coal from 1919 to 1923
Gas yield, 15. deg. C. end 760 millimeters	32.2%	23.2%	28%
Coke yield.....	63.8%	70.6%	....
Ash content in coal..	11.9%	49.3%	....
Combustible matter in coal	88.1%	50.7%	.. 42%
Heating value of the gas at 15 deg. C. and 760 mm. average for one kilo-			
Condition of coke...	normal	sintered	....
kilogram of coal..	1587 Cal.	1106 Cal.	30%

It is evident from this tabulation that the coal suffered severely by the weathering action. As far as the composition of the gas produced was concerned, that made from the surface coal contained considerably less carbon monoxide, methane and hydrogen than the unchanged coal, while the nitrogen and carbon dioxide contents were increased and the gas contained 1.6 per cent of oxygen. The other gas contained none.

Presence of Pyrite

The presence of pyrite in the American hard coal was detected either by the naked eye or by means of the microscope. The total percentage of sulphur in the coal, taken from the surface of the pile, was 2.57 per cent and that taken from the interior of the storage pile was 1.89 per cent. The greater percentage of sulphur in the surface coal is due to the weathering influence on the coal.

The appearance of the coal pile was not prepossessing in itself, for it consisted of large quantities of small pieces of coal, dust and small coal. During the four-year period of weathering the coal pile was subjected to temperatures which showed no abnor-

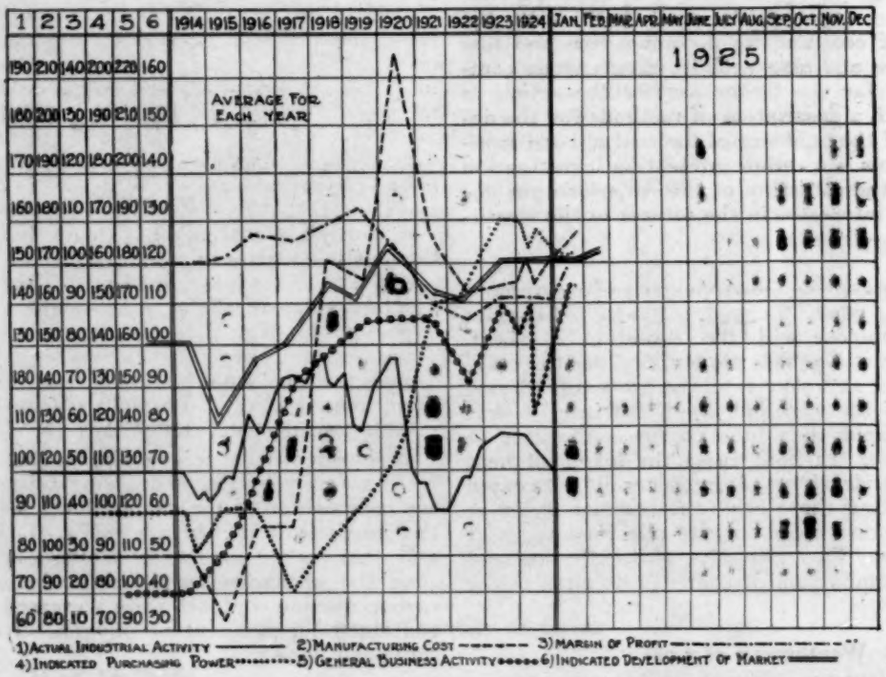
(Continued on page 169)

Marked Improvement Indicated

Manufacturers' profit margin normal--Credit situation requires attention

L. W. Allwyn-Schmidt

THE past month has aided greatly in clarifying the situation. It has intensified the general tendency for economic improvement which now should proceed without further hindrance. To the student of market phenomena, and every manufacturer should apply himself to this very profitable science, the present constellation of the market contains a number of rather interesting features. Market strength or weakness is measured as a rule by the respective energy of certain leading industries. In times of general prosperity these industries act as a rule in absolute harmony, sharing equally in the general advancement. No such harmony, however, is noticeable during the present economic period, and while, for instance, the steel industry is very busy there come still serious complaints from certain branches of the textile industry. This occurrence, for which other examples might easily be quoted, demands some investigation.


1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC
1925
AVERAGE FOR EACH YEAR
1) Actual Industrial Activity
2) Manufacturing Cost
3) Margin of Profit
4) Indicated Purchasing Power
5) General Business Activity
6) Indicated Development of Market

Division Into Primary and Secondary Industries

To understand the present development it is necessary to divide the various industrial groups in what for this purpose might be called primary and secondary industries. The first are those which develop a raw material for further improvement; the second are those which turn an improved new material into consumers' merchandise. Just now prosperity seems to have struck the primary industries, leaving the secondary and latter groups still more or less in the cold. While this, no doubt, is very inconvenient for these groups of national industry, it is in itself an exceedingly satisfactory sign. Because it indicates an economic reconstruction of the national markets from the bottom upwards, a condition which indicates invariably a particularly strong upward movement of the economic wave. It proves conclusively that the receding movement of last year has stopped and that the market has accumulated strength for a very strong upward move which most likely will carry it to a new record.

Normal Margin of Profit Reached

This view is supported by the fact that our industry for the first time since the war has reached again a normal margin of profit, provided we accept the profit margin obtained during the year 1914 as normal. This development has been indicated during several months by the slow rise in the price of manufactured merchandise combined with the steady adjustment of wages. All through the years fol-

(Continued on page 173)

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

Lesson No. 58

Change of State *(continued)*

The Heat in Water and Its Power

THE following examples clearly illustrate the great amount of heat that is contained in water and the corresponding effects that it can produce in heating up other substances. There is introduced in this example the latent heat of evaporation, which will have to be accepted as such without explanation for the present.

Thus it is stated that in heating a pound of water from 32 degrees F. to steam at 212 degrees F., there are required 1150.4 B.t.u. Now the question is, what effect will this heat have on 100 pounds each of iron, mercury, clay and stone, when the initial temperature is 32 degrees F. in each case.

HEAT CONTAINED IN WATER AND ITS POTENCY
One Pound of Water
Heated from 32°F. and changed into Steam at 212°F. will contain — 1150.4 B.T.U.
Heat in Water will raise Temperatures of
(Start at 32°F.)
100 Pounds of Iron to 86°F.
100 Pounds of Mercury to 380°F.
100 Pounds of Clay to 90°F.
100 Pounds of Stone to 89.5°F

The calculation is simple and depends on the general formula:

B.t.u.=Temperature difference × specific heat × weight.

From the tables it is found that the specific heats of iron, mercury, clay and stone are 0.218, 0.0333, 0.197 and 0.2, respectively. If the new temperature is assumed to be x, then the equations may be written in the following form:

$$1150.4 = (x - 32)\ (100)\ (0.218).$$
$$1150.4 = (x - 32)\ (100)\ (0.0333).$$
$$1150.4 = (x - 32)\ (100)\ (0.197).$$
$$1150.4 = (x - 32)\ (100)\ (0.2).$$

Solving these equations for x, we obtained the following:

$$x = \frac{1150.4 + 32 \times 21.8}{21.8} = \frac{1878}{21.8}$$

$$x = \frac{1150.4 + 32 \times 3.3}{3.3} = \frac{1257}{3.3}$$

$$x = \frac{1150.4 + 32 \times 19.7}{19.7} = \frac{1780}{19.7}$$

$$x = \frac{1150.4 + 32 \times 20}{20} = \frac{1790}{20}$$

The results then are as follows: 86 degrees F. in the case of iron, 380 degrees F. in the case of mercury, 90 degrees F. in the case of clay and, finally, 89.5 degrees F. in the case of stone.

The Gas Company and the Appliance Maker*

Why closer co-operation between gas company and appliance manufacturer is necessary

Harry Schall

Vice-President Standard Gas Equipment Company

THE topic given me to discuss, "Why Closer Co-operation Between Gas Company and Appliance Maker Is Necessary," is one of vital importance to the gas industry. It is also one that has been given far too little attention.

The use of gas in the home and in the industry has been extended so rapidly that much of the detail of design and distribution has received very little attention, and both manufacturer and distributor have acquired many bad business habits.

I am now speaking for the manufacturer who has the best interests of the industry at heart, and desires only to improve his product and to place at the disposal of the public—the ultimate purchaser—the highest expression of the art.

The distributor of gas cannot afford to discourage such a desire, for it is of paramount importance in the sale of his own product.

Contact for Co-operation

The contact for co-operation may be divided, roughly, under three heads:

(1) Design and construction.
(2) Sales methods.
(3) Terms and conditions.

You who are connected with the manufacture and sale of gas come into more direct contact with the actual user of your product than does the manufacturer. You are, therefore, in position to learn the factors that are of the most interest to them.

The progressive manufacturer is just as much interested in this point of view as you are. He has spent thousands of dollars in his laboratory trying to devise appliances that would give the most service with a maximum of comfort and convenience in the home and a maximum of economy and efficiency in the factory or workshop. He has spent thousands of dollars for gas in the conduct of his experiments. The gas company laboratory can test appliances—they can determine factors of safety and construction, but from the very nature of their business are not in position to determine the factors of commercial values or utility. The gas industry may well encourage the progressive manufacturer in his experimental work, giving their advice freely, drawing from the fund of information they obtain because of their intimate contact with the public.

The art of making useful gas appliances has been developed through careful and painstaking work on the part of the manufacturer. In many cases it has taken a great deal of courage and vision, as well as costing a great deal of money to do the necessary experimental work. It is the investment the manufacturer makes in the industry. The improvement of the industry in general means the improvement of the individual engaged in it, and the gas company cannot afford to discourage the manufacturer in this work.

*Delivered before the mid-year meeting of the New Jersey Gas Association.

Those That Copy

There is, unfortunately, a class of manufacturers just entering the industry who has made no investment in experimental work—has done nothing to improve design or construction—has suffered none of the growing pains—knows nothing of the fundamentals of the business of serving gas fuel. He just copies.

Because he has made no investment for patterns or design, and because he has no interest in the industry as such, he can maintain a low overhead and a low cost. Such a concern, if supported by the gas company, cannot fail to discourage the legitimate manufacturer from further effort to improve. A manufacturer should be encouraged to commercialize his own ideas and design his own appliances, but should not be supported when he appropriates the ideas and designs of others.

Sales Methods

It is only lately that much attention has been given to the sales methods. The average gas company man has a multitude of duties—care of accounts, public relations—new services—care of services already installed—sometimes even the purchases and the actual manufacture of gas. It naturally follows that he has very little time to devise sales programs, and, excepting a very few of the large companies, has very little training along that line. The established manufacturer, on the other hand, gives a large portion of his time to this subject. Many times he organizes a department for this work, and is, therefore, in a position to devise sales plans that are practical and do the work. It costs a little money but can be done much cheaper if the individual gas company attempted to make its own plans.

The gas company is organized primarily for the purpose of making a fuel to be sold in competition with all other fuels to the public. The matter of selling appliances follows naturally as a means of distributing more of the fuel. The more boosters you have for gas as a fuel the better is your business. Encourage the sale of gas appliances in your community. Encourage the dealer. Encourage the manufacturer who devises original plans in selling.

(Continued on page 164)

As The Journal Views It

GAS AND OIL

In one way or another, oil has always been of interest to the gas industry. Today the gas man is more concerned with oil than he has ever been during the entire history of gas. Furthermore, the average business man, as well as legislatures, are today paying more attention to oil than ever before.

In other words, oil is now the topic of the day. The gas industry has direct contact with oil in more ways than one. It uses a product derived from the distillation of petroleum in the manufacture of gas, as well as for the purpose of increasing the thermal value of water gas. Then, again, gas competes with oil particularly in the industrial field, but also to a certain extent in the domestic field as well. It is, therefore, no surprise that the leaders of the gas industry today are much concerned with the developments that have been taking place in the oil industry as well as with the indicated future conditions that will soon arise in this industry.

At the recent Mid-Winter Conference of executives of the American Gas Association, held in San Francisco, President Abell of the Association laid considerable stress on the connection between conservation of oil resources and the gas business. It is now generally conceded, even by the oil people themselves, that the sources of oil in this country are limited. The only bone of contention seems to be on the question of how severe this limitation is. Certainly—and this was pointed out more than a year ago in one of the early articles of the Fuel of the Future Series published in the American Gas Journal—there is no question, we say, but that all are agreed that oil does not possess the characteristics of a universal fuel. This is true if for no other reason than the fact that the supplies of oil are limited. No fuel can become universal in application under such conditions.

Oil has been competing with gas in both the industrial and domestic field. In certain districts of the country this competition has been found to be rather severe. Particular attention has been paid by oil men to the house heating field, and it has also been a contender with gas for industrial business. It has, accordingly, been stated that the conservation of oil resources, a movement which will soon be in full progress, will open up business for the gas industry that it can readily secure. It has also been indicated that the gas business has nothing to fear from oil as a competitor fuel.

There is no doubt that these statements are accurate and form a correct picture of the conditions that exist today in the oil business and that will soon become even more prevalent. It is logical that gas should get this business, and it will get it if gas men go after it. It seems, moreover, even more advisable not to wait for conditions to become so stringent in the oil field that oil can no longer compete with gas as an industrial and domestic fuel, but rather to combat oil as a competitor fuel at once so that the time of its final expulsion from these fields will be hastened.

There is another phase of this development which is of interest to the gas man. He uses gas oil in carburetting water gas. Gas oil is a cheap product. As petroleum becomes scarcer, it will be used more and more excessively for making the more expensive products that are now obtained from it, such as gasoline and lubricating oils. It is known today that cracking processes can be developed to such a degree of perfection that practically all of the petroleum can be converted into lower boiling point and more valuable products.

Thus gas will have eventually to secure carburetting oil from some other source. The question whether such oils can not be derived from coal tar is an open one. Furthermore, it remains to be seen whether or not gas business will be able to do away with carburetting gas and distribute straight water gas instead.

Thus it is evident that oil and gas are closely related and that developments that take place in one are of interest to the other. Oil is going to become scarcer and scarcer in this country and it is hard to conceive how the demand will be taken care of even through foreign importations. This leaves

the field open for gas. It points out, moreover, very clearly to the gas man that he has a fuel which possesses characteristics that none of the other fuels have. It points out to him that his fuel is the universal one and that if all work together it will not be very long before gas attains its great goal.

THE GAS COMPANY AND THE APPLIANCE MAKER

(Continued from page 162)

Do not encourage the manufacturer who is able to sell at a low price because he has invested no money in his own plans, but copies the plans of others.

Low prices may make for sales because of low sales resistance, but they often mean trouble afterward, and trouble with your service does not increase the use of the fuel you are selling.

Use of Modern Business Methods

Finally, you can co-operate for modern business methods. Any business man figures his cost before he figures his selling price, so that he includes in his costs all allowances he makes, and if he makes none, none are included.

Archaic forms of cash discount, unlimited freight allowances, special or secret rebates, are gradually being done away with by all large manufacturers. They are not essential in the distribution of their product to the public—they are often misused. They are a form and not a substance. Co-operate so as to have uniform terms and one open price quoted when there will be no question of whether or not you are getting all that is coming to you.

Remember this—the prosperity of the manufacturer, as well as your own, depends on the progress of the industry, and you owe it to yourself to co-operate in every phase—to encourage initiative—that the sale of gas may increase and you and your business prosper.

In conclusion, I might repeat an apt remark of one of my associates: "It is cutting coupons rather than in cutting prices that enables us to enjoy a few of the better things in life."

"The Whole Town's Talking"

Description of a gas company's safety work

YES, and some from out of town are talking about the annual Safety Meeting of the Malden & Melrose Gas Light Company Club, January 15, 1925, at the Auditorium ball room.

Yes, and some from out of town are talking about the annual Safety Meeting of the Malden & Melrose Gas Light Company Club, January 15, 1925, at the Auditorium ball room.

After dinner was served, the president, Mr. John F. Morey, called the meeting to order. The salute to the American flag was given, followed by the singing of "The Star Spangled Banner," Van Riper's Orchestra accompanying.

Mr. A. Ernest Walters, chairman of the committee and the instructor on safety, took charge of the meeting and presented a program far above expectation.

Preparing the "Victim"

An International film, "Paying the Price," was shown, giving very definite results of neglect in reporting and caring for slight accidents. The picture was described by Safety Engineer T. J. Whelan, of the Travelers Insurance Company, Boston.

After introductory remarks by Mr. George Muse, of the Malden Electric Company, a playlet entitled "A Close Call," was presented by gas men.

Dr. E. W. Bullock assisted, taking the part of the doctor.

Radio Used

The novel method of getting the Safety Message across to the audience was introduced in the form of a radio broadcast.The broadcasting was done from Station MMGL-Wave length 528 B. T. U.

Safety dealing with its various phases was broadcasted by the gas men, the program being as follows:

The Idea of Safety—Mr. R. S. Carter, superintendent of production.

First Aid in the Industry—Mr. W. B. Gibby. superintendent of distribution.

Auto Hazard—Mr. B. P. Bill, superintendent of transportation.

Safety in the Home—Miss Cory S. Thompson.

Safety Principles (in Italian)—Mr. Frank Tomassi

Life—Mr. Joseph Leighton.

A Practical Demonstration

Immediately following the broadcast, the "hit of the evening" occurred when five men attired in attractive white uniforms stepped on to the stage and demonstrated the practical application of first aid methods.

The team consisted of the following: A. Ernest Walters, captain; Benj. P. Bill, Jr., Oliver Pulsifer, Ronald Fritz, John S. Carter.

(Continued on page 166)

PROGRESS IN GAS TECHNOLOGY
Domestic and Foreign

Regulating Gas Supply to Burners

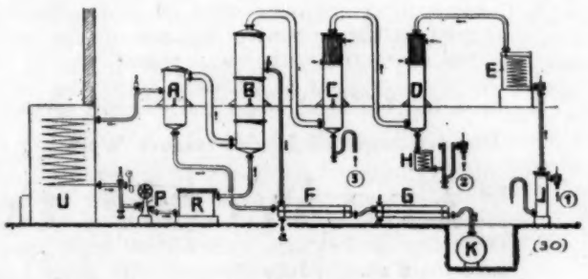
BRITISH Patent No. 223,413 is concerned with a device for regulating the supply of gas to atmospheric burners. It refers to means of regulating the gas supply to atmospheric burners for gas fires and the like, and refers to means of that type wherein a coiled spring is disposed within, and is of a smaller diameter than, the gas supply or injector tube, and is located between a pair of discs or other suitable members; the arrangement being such that the gas is compelled to pass between the coils of the spring on its way to the injector nozzle. Suitable externally-operated means are provided to move the discs or other members relatively towards or away from each other, in order more or less to close or open the coils of the spring, and thereby regulate the gas passing to the mixing chamber of the burner. A plug carried by one end of the injector tube has a passage communicating with the interior of the coiled spring, one end of which is carried and positioned by the plug, while the other end is carried and closed by a non-rotatable member abutting against a perforated end cap or injector nozzle carried by the other end of the injector tube. This non-rotatable member is fluted or cut away to permit the gas to pass to the injector nozzle; the coils of the spring being opened or closed by adjusting the plug or the end cap or injector nozzle.

Removal of Benzol from Gas by Waste Heat

A NEW process for the removal of benzol from gas is described in German Patent No. 326,730, wherein waste heat is employed for the purpose, the process being carried out in the apparatus shown in the accompanying illustration.

The benzol-enriched wash-oil is introduced at A to the heat-interchanger F, where it is preheated by the hot debenzolized oil. From here, it passes by way of b to the column still B, where it is treated by a counterflow of wash-oil vapors at about 250 degrees C. from A. This vaporizes the greater portion of the benzol; and the wash-oil, with its small remaining content of benzol, passes, by way of the intermediate container R and the pump P, to the heating system in the oven U, which is heated by waste gases at 400 to 500 degrees C. Here the wash-oil passes in continuous stream through a tube system of special design, and in the opposite direction to the heating gases; and in a very few minutes it is raised to about 250 degrees C. At this temperature it reaches the vapor separator A, where it gives up, as vapor, the rest of the benzole, as well as part of the wash-oil, before flowing back through the heat-interchanger F and the water cooler G to the container K, where it is ready for further use in the washing process.

As already shown, the vapors from A pass into the column still B, where they serve to drive the greater part of the benzol out of the enriched oil, which arrives by way of b. The system is so devised that only light-oil vapors leave B at the top, while the higher-boiling oil fractions are recondensed in B, and taken on again by the flow of oil. The light-oil vapors from B pass to the purifier C, where, by



cooling, they are freed of all the higher-boiling wash-oil fractions. The latter are drawn off by (3) into special cooling pans, in which naphthalene separates out by crystallization; and they are then ready for further use. Therefore, only purified benzol vapors pass out at the top of C; and, by fractional distillation in D and in the final condenser E, they are received at (1) and (2) as light and heavy benzol respectively.

The absence of steam has many advantages, e. g., no cost of steam raising, less cooling water and smaller plant required, no thickening of the wash-oil, sharper fractionation into light and heavy benzol in fractional condensers. The cost of production of the benzol is reduced by 50 per cent as compared with the usual method of debenzolizing with steam.

High Pressure Distribution in Great Britain

AN article recently appeared in the Gas World of January 10, 1925, describing the distribution of gas under high pressure in England and the experiences that have been undergone with this system.

The article describes the manner in which the mains were laid, the methods employed in making the joints, which were of the oxy-acetylene welded type. It also described the manner in which the mains were tested. In this case a portable engine was employed connected to a portable compressor, and after sealing the ends of the length of main pressure was applied and gauged with a steam pres-

sure gauge. All joints were then inspected and tested with oil to see if any leak took place through them. The test lasted for about two hours.

The manner in which the house governor connections were made from the main to the house is indicated in the accompanying sketch. The advantages and disadvantages of high pressure work were summed up in the article to be as follows:

Advantages of High Pressure Work

1. Constant pressure at consumers' meters.
2. Two or more consumers can be supplied from same pipe without risk.
3. No naphthalene deposits or water-logged services.
4. Pipes can be laid at less depth and at any level.
5. The severe tests applied insure a much higher standard of workmanship.
6. Less capital cost per mile of main, having regard to the increased volume of gas conveyed compared with low pressure.
7. Greater flexibility as demand increases.
8. Last, but not least, good and efficient service.

Disadvantages of High Pressure Work

The disadvantages were stated as follows:

1. Dependent on mechanical means for raising pressure.
2. Difficulty in welding branches on high pressure main after being charged with gas.
3. Probable shorter life of mains, although this is a debatable point and one that can only be settled in the course of time.
4. Regulators being thrown out of action owing to rust or other foreign matter.

"THE WHOLE TOWN'S TALKING"

(Continued from page 164)

The problem presented by the captain was as follows:

A man loses his balance while working on top of an oil tank and falls to the ground, receiving these injuries:

Right eye bruised.

Left lower jaw broken, with cut on left cheek—no hemorrhage.

Dislocated left shoulder.

Cut 6 inches below knee inside of right leg, spurting blood.

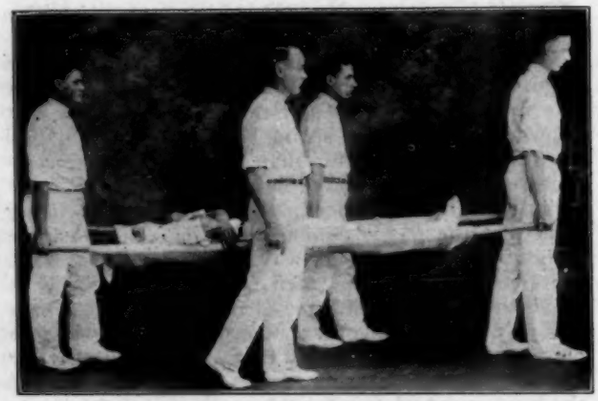
Simple fracture of right thigh 4 inches above the knee.

With one man acting as patient, the other four treated his injuries. The result of the completed problem was clearly illustrated as the injured person was carried through the aisles of the hall so that every one might view the bandages and the work the men had done. Expressions of highest commendation were heard on every hand.

One Man Carries

Demonstration and explanations were given on one-man carries by Mr. Walters, using John S. Carter as a subject. Mr. Carter, although the heavyweight of the team, was easily lifted to Mr. Walters' shoulders and carried from the platform, proving that weight and size are no hindrance in performing this act.

Following these features, addresses were made by Mr. Frank L. Ball, of Fitchburg Gas & Electric Light Company, who pointed out the value of "Safety in Tenney Service"; Mr. Frank J. Perry, of the Travelers Insurance Company, who outlined the rights of operators of motor vehicles approaching intersecting streets; Dr. E. W. Bullock, who cited specific cases to prove the value of "Prone Pressure and First Aid," and Mr. J. T. Day, local manager, who spoke on the value of health conditions to the employees, urging every individual to take advantage of the yearly physical examinations.



Transporting the "Victim"

"The Safety Message" was surely put across as never before and everyone went home with a determination to get into this work without delay.

$20,000,000 IN UTILITIES ADVERTISING

Executives of public utility companies will take an important part in the convention of the Associated Advertising Clubs of the World, to be held at Houston, Texas, May 10 to 15, according to an announcement made public by William H. Hodge of Chicago, president of the Public Utilities Advertising Association.

Mr. Hodge says that the annual advertising expenditures of the country's public service companies exceed $20,000,000 with the trend distinctly upward at the present time, due to unprecedented demands for service.

At the Houston convention the public utility men will hold two sessions of their own. Subjects to be discussed are "Costs and Results," "Better Copy," "Keeping an Organization Abreast of Its Advertising," "Motion Pictures," and "Good Will and Institutional Advertising."

The membership of the Public Utilities Advertising Association consists of about 300 advertising men of gas, electric light and power, telephone, street railway and water companies. Twenty years ago there were not a dozen advertising men in the entire public utility industry.

Catechism of Central Station Gas Engineering in the United States

Installment No. 58

(Continued from last week)

Ans. In 1,000 cubic feet of gas having the composition of Sample No. 1, there will be:

16	cubic	feet of	CO_2
4	"	" "	O_2
43	"	" "	C_2H_4
80	"	" "	CO
470	"	" "	H_2
360	"	" "	CH_4
5	"	" "	C_2H_6
22	"	" "	N_2

The respective weights per cubic foot being:

CO_2	0.11634 lb.
O_2	0.08462 "
C_2H_4	0.07404 "
CO	0.07404 "
H_2	0.00529 "
CH_4	0.04231 "
C_2H_6	0.07933 "
N_2	0.07404 "

the weights in 1,000 cubic feet are:

CO_2	$16 \times 0.11634 =$	1.86 lb.
O_2	$4 \times 0.08462 =$	.34 "
C_2H_4	$43 \times 0.07404 =$	3.18 "
CO	$80 \times 0.07404 =$	5.92 "
H_2	$470 \times 0.00529 =$	2.49 "
CH_4	$360 \times 0.04231 =$	15.23 "
C_2H_6	$5 \times 0.07933 =$	.40 "
N_2	$22 \times 0.07404 =$	1.63 "

and the total weight of 1,000 cu. ft. of gas is ..... 31.05 lb.

The weight of 1,000 cu. ft. of air is 76.357 lb. and therefore the specific gravity of the gas is $\frac{31.05}{76.357} = 0.406$.

By the same method of calculation it is found that the weight of 1,000 cubic feet of the gas having the composition of Sample No. 2 is 48.72 lb. and its specific gravity is 0.638.

A Balloon Problem

300. Under what conditions will a balloon rise when filled with a gas lighter than air, and how much weight can be lifted by a balloon filled with 2,000 cubic feet of gas, having a specific gravity of 0.6?

Ans. A balloon will rise only when its total weight with all appurtenances is less than the weight of the air displaced by it. The case is, to a certain extent, the same as that of equal volumes of two liquids, which will not mix, and have different specific gravities, placed one in each leg of a siphon gauge. The heavier liquid will force up the lighter until its upper surface stands at a level which is higher than the level of the upper surface of the heavier liquid by an amount proportional to the difference in weight between them. In this case a state of equilibrium is soon reached owing to the limited quantity of the heavier liquid present to take the place of the lighter liquid as it is forced up, but with the balloon there is an unlimited supply of air to fill up the spaces successfully vacated as it rises, and the ascending motion continues until a height is reached at which, owing to the elevation, the weight of the air displaced has become so much reduced as to be only equal to the weight of the balloon and its attachments. At this height the balloon will float as long as no change is made in its weight, in that of the air per unit of volume, or in the volume of air displaced.

Determining the Weight

To determine the weight (including, of course, the weight of the balloon itself) that can be lifted by a balloon filled with 2,000 cubic feet of gas having a specific gravity of 0.6, it is assumed that both gas and air are dry and at a temperature of 60 deg. F. and a pressure of 30 in. of mercury, and that the displacement of the balloon is equal to the volume of gas contained in it. The last assumption, while not perfectly accurate, is sufficiently so for all practical purposes. Since a cubic foot of dry air at the temperature and pressure named weighs 0.076357 lb., 2,000 cubic feet will weight 152.714 lb. The 2,000 cu. ft. of gas in the balloon having a specific gravity of 0.6 will weigh 152.714×0.6, and, therefore, the weight of the air displaced will exceed the weight of the gas by $152.714 \times 0.4 = 61.0856$ lb., and the balloon can lift any weight less than this.

301. How much weight (including its own weight) will a balloon containing 1,000 cubic feet lift when filled with pure hydrogen? With a gas of 0.420 specific gravity? With gas of 0.650 specific gravity? Give the calculations you make in obtaining the answers to this question.

Ans. "If a balloon is at equilibrium at the surface of the earth, according to the laws of buoyancy, the weight of the balloon and contents is equal to the weight of the air displaced."

Assuming that the air and gas are at a temperature of 60 deg. F., and the barometer is at a height of 30 in. of mercury, 1,000 cubic feet of air weigh

76.36 lb. 1,000 cubic feet of hydrogen (specific gravity 0.0693) weigh 76.36 × 0.0693 = 5.29 lb.

If we displace 1,000 cubic feet of air, weighing 76.36 lb., in the balloon with 1,000 cubic feet of hydrogen, weighing 5.29 lb., the balloon will suspend without lifting.

76.36 — 5.29 = 71.07 lb., less the weight of the balloon.

1,000 cubic feet of gas with a specific gravity of 0.420 weighs 76.36 × 0.420 = 32.07 lb.

Hence the balloon when filled with this gas will suspend without lifting.

76.36 — 32.07 = 44.29 lb., less the weight of the balloon.

1,000 cubic feet of gas with a specific gravity of 0.650 weighs 76.36 × 0.650 = 49.63 lb.

Hence the balloon when filled with this gas will suspend without lifting.

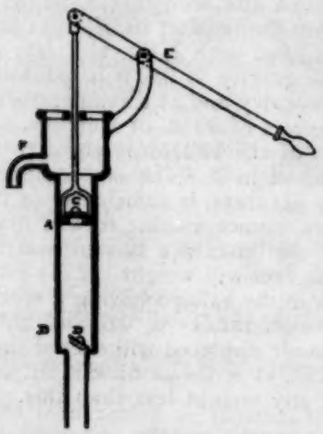
76.36 — 49.63 = 26.73 lb., less the weight of the balloon.

The balloon will lift (rise with) any weight less than the above.

The Suction Pump

302. How does a suction pump "draw" water? Why and how does a hot chimney "draw"?

Ans. A suction pump, as shown in section in the sketch, is provided with a piston, C, and two valves, one in the piston and the other at the point, D, where the suction pipe enters the cylinder, A B. These valves are set in such a manner as to cause water or air to be pushed out of the delivery pipe, F, of the pump to permit water to enter from the



Suction Pump

suction pipe into the space below the piston during the up stroke, and also to permit water to travel through the piston from below upwards while preventing any flow of water from the cylinder back into the suction pipe during the down stroke of the piston. Such a pump, therefore, "draws" water by the forcing out from the cylinder of the water, or air, in the space above the piston as this is raised, and thus, by decreasing the amount of water, or air, left to fill the original space, reducing the pressure in the lower part of the cylinder, and in the suction pipe, below that exerted by the atmosphere. The surface of the water outside the suction pipe being thus subjected to a higher pressure than the surface inside this pipe, water is pushed into the pipe and through it into the cylinder of the pump to a height above the outside level, dependent upon the amount by which the action of the piston reduces the pressure in the pipe and cylinder below the outside pressure. The pressing up of the water continues as long as the pump is working and delivering water, the space occupied by the water thrown off by each stroke of the piston being filled by water forced in by the excess of pressure on its outer surface. The water is thus moved, not by a pulling force, as is implied by the commonly accepted way of describing the working of a suction pump by saying that it "draws" water, but by a pushing force, each molecule of water being moved along because the pressure behind it is greater than that in front of it.

In the same way the draft of a chimney is caused by a difference of pressure at the base of the chimney, due to the difference between the weight of the column of hot air and products of combustion in the chimney and that of a column of cold external air, of equal height and cross section. The contents of a chimney being all cold, there is no tendency of the air, or the gas within it, to rise or fall. The contents being heated, either from the warm sides of the chimney, or otherwise, expand. A portion of them, by this act of expansion, is forced out of the chimney; the rest of the contents, being expanded, are lighter, by the weight of the amount forced out, than the surrounding atmosphere, and will be displaced by the heavier air pressing for admission at the base of the chimney. A flow through the chimney is thus established, and will be maintained as long as the pressure of the atmosphere at the base of the chimney is greater than the downward pressure of the contents of the chimney.

Workings of an Exhauster

303. How does an exhauster "draw" gas?

Ans. An exhauster does not "draw" gas in the sense in which the word draw is used to denote the action of pulling objects towards one by means of a string. An exhauster acts by forcing out from the space between its inlet and outlet some of the gas previously occupying such space, and thus reducing the pressure existing within this space below that existing in the pipe leading to the inlet of the exhauster. The difference in pressure thus formed causes a flow of gas from the inlet pipe into the exhauster, and as a consequence a flow of gas through all the apparatus preceding the exhauster so long as the exhauster is running and fresh gas is supplied to take the place of that forced away. The action is thus one of pushing and not of pulling, the gas moving along because at each point of its path the pressure is higher than that in front.

(Fifty-ninth Installment Next Week)

THE DECOMPOSITION OF ANTHRACITE COAL

(Continued from page 159)

mal variation. The minimum was plus 10 degrees C. and the maximum was plus 26 degrees C., the average being plus 17 degrees C.

It is very clear that there was a considerable loss of heat value in the coal near the surface of the storage pile which was subjected to strong weathering.

Spontaneous Combustion of the Coal

A pile of English hard coal was stored for about eight months. It was found to be subjected to strong heating in the interior. A few days after this was first noticed the coal burst into flame, due to spontaneous combustion, and the fire had to be quenched with water and the pile had to be broken down. A strong biting smell pervaded the atmosphere all day around the storage pile.

The laboratory of the gas works was requested to determine the cause of the spontaneous combustion of the coal. For this purpose various samples of the coal were taken from cold as well as warm places in the storage pile. The stored coal was air-dried and had a good, fresh, pitchy black appearance. The pieces of coal were quite large and were mixed with only a small amount of small coal, powder and dust. The many pieces of coal in the sample of the size of the hand, when broken apart, showed strongly lustrous fracture surfaces which were intermingled with many thin light yellow flakes of pyrites. The feel of the fractured surface was cold. Part of the coal, however, gave cleavage surfaces of a dark gray matte color without any pyrite content.

Appearance of Coal Under Microscope

When the gray mass was observed under the microscope, magnified 80 diameters, it was seen to contain many agglomerations of pitchy black particles as well as long vegetable cellulose matter which was filled with a whitish mass which was barely visible under the glass. The contents of these cells were isolated and tested by microchemical methods. It was found that this mass was insoluble in benzol, ether, acetone water, diluted hydrochloric acid and concentrated sulphuric acid. Thereafter it was noticed that the substance did not behave like an organic material, nor like a resin or a paraffine, as was thought at the outset it must be. It was seen to be an additional filling of the cells caused by infiltration of silicic acid or a silicate.

The peculiar characteristic of these dull pieces of coal was that, in contradistinction with the aforementioned lustrous coal, it was all more or less warm to the touch.

It would therefore appear that the spontaneous combustion of the coal was due to the presence of these dull colored pieces of coal in the mass, or, at any rate, that this was one of the principal reasons for the phenomenon.

Testing Coal for Spontaneous Combustion

There are a number of methods which can be used in testing the coal to determine the ease with which it will burn spontaneously. However, the value of these methods has always been questionable. They are all based on the fact that the spontaneous combustion of the coal (hard coal) is due to the absorption of oxygen or of halogens by the greater or lesser amount of unsaturated organic hydrocarbons that are present in the fuel. On the other hand, the presence of sulphur in the form of pyrite in the coal plays only a subordinary role, but enhances the oxidation and heating up of the coal itself.

However, the condition that special apparatus is necessary for carrying out the tests prevented their adoption throughout the industry.

Bromine Absorption by Coal

In order to obtain comparable bromine absorption coefficients, a sample of anthracite coal, weighing 0.25 gram, is rubbed together with five grams of ignited pure quartz sand and ten cubic centimeters of water. The operation is carried out in a porcelain motar and is completed in fifteen minutes.

Then the entire mash is filled into a liter flask which is provided with a ground glass stopper. There are then added to the flask 100 centimeters of a 0.6 per cent solution of potassium bromide. a similar amount of a one-hundredth normal potassium bromate and twenty cubic centimeters of a dilute solution of sulphuric acid (one to one). The whole mass is then shaken up for one and one-half hours in a shaking machine.

The bromine that is set free during this operation by the sulphuric acid is absorbed by the coal to a greater or lesser extent. Then through the addition of four grams of solid potassium iodide and further shaking for a short time the excess bromine is replaced by the free iodine.

Then the mass is filtered through a folded filter paper and the residue on the filter paper is then washed with water and thereafter the excess iodine or bromine that is present in the filtrate is titrated with tenth normal solution of sodium thiosulphate.

A Blank Test Is Made

A blank test was made with the above quantities of materials, but without the addition of coal, and this was found to require 60.2 cubic centimeters of sodium thiosulphate. If the consumption of sodium thiosulphate, which corresponds to the absorption by a 0.25 gram sample of coal, is deducted from this quantity, then the resulting difference in the amount of thiosulphate employed corresponds to the quantity of bromine that is absorbed by the coal.

Inasmuch as one cubic centimeter of tenth normal

sodium thiosulphate corresponds to 0.0008 gram of bromine, the aforementioned difference in thiosulphate consumption must be multiplied by 0.008 in order to arrive at the bromine consumption of 0.25 gram of coal. This figure can be easily converted to the basis of one gram of coal and the result is then called the bromine coefficient of the coal.

Oxidation With Permanganate

The oxidation of the anthrocite coal with the aid of potassium permanganate may be carried out in a number of different ways. In this connection the most important considerations are the degree of dilution or the quantity of water used in the process, the quantity of coal employed, the temperature and the duration of the test. Hence it follows that if comparable results are to be obtained it is absolutely necessary that the various conditions, noted above, be maintained constant. Even slight changes in these conditions will result in inaccurate conclusions being drawn from the observations in the tests. Furthermore, the degree to which the coal is pulverized is also an important factor in the test. For the same reason the practice of rubbing the coal together with pure, ignited sand must also be carried out with care. The size of coal particles in the sample employed for testing was from 0.005 to 0.2 cubic millimeters. This fineness of particles was attained by grinding the coal for half an hour in a ball mill with forty steel balls, possessing a total weight of twenty-five kilograms.

Little Water Essential

In the presence of a small amount of water the coal can be rapidly and completely oxidized with the aid of potassium permanganate, but when this operation is carried out in a very dilute medium, then a certain difference arises which bears a definite relation to the molecular make-up of the coal and the condition of the coal at the moment.

The following method has been found to be most suited for the determination of the difference in degree of oxidation of various anthracite coals. The method requires simple reagent and simple apparatus.

Eight hundred cubic centimeters of distilled water are placed in a porcelain dish which has been first made scrupulously clean. This dish has the capacity of one and one-half to two liters. There are then added ten cubic centimeters of concentrated sulphuric acid and one hundred cubic centimeters of ten normal potassium permanganate. Then there is prepared a sample of the coal which is made from 0.1 gram of coal, two grams of pure quartz sand and five cubic centimeters of pure distilled water, the whole mass being rubbed together in a clean, roomy porcelain mortar for a period of fifteen minutes.

Further Conduct of the Test

As soon as the thermometer in the above solution reaches 70 degrees C., the mixture of ground coal and quartz, in the diluted solution of potassium permanganate is wet with a little water and then a stop watch is set running. The oxidation of the coal takes place while the mixture is being constantly stirred with a glass rod and the temperature during this time is maintained closely at 70 degrees C. The reaction is allowed to proceed for a period of exactly five minutes and in order to stop the oxidation suddenly and completely one hundred cubic centimeters of a tenth normal solution of oxalic acid are added in one mass. When this is done, the deep red color of the solution disappears at once and a precipitate of brown manganese dioxide is formed. A previous test was made of the sample of coal in cold, weak sulphuric acid solution to determine if it contained any ferrous salts. This test was negative. Therefore, the conclusion may be drawn that the oxidizing action of the potassium permanganate was on the organic constituents of the coal only.

The solution is then filled in an accurate liter flask exactly to the mark. It is then shaken thoroughly and five hundred cubic centimeters of this solution are filtered through a folded filter paper. The excess oxalic acid in this solution is determined by titration with half normal potassium permanganate. The titration is carried out at a temperature of 70 degrees C., and the end point of the titration is determined by a permanent rose color in the solution.

The Calculation

The following example will illustrate the manner of calculating the permanganate number of the coal:

First addition of approximately tenth normal permanganate	100.0 cu. cm.
Back titration with tenth normal permanganate per liter.....	38.6 cu. cm.
Total consumption of tenth normal permanganate solution.....	138.6 cu. cm.

Inasmuch as the permanganate solution was not exactly tenth normal—ten cubic centimeters of tenth normal oxalic acid correspond to 9.75 cubic centimeters of the permanganate solution—the above consumption of potassium permanganate solution must be multiplied by the factor $10 \div 9.75$, or 1.025.

Total consumption of tenth normal permanganate 138.6×1.025.....	142.0 cu. cm.
Deduction of the hundred cubic centimeter of oxalic acid added.....	100.0 cu. cm.
Hence the consumption of permanganate for 0.1 grams of coal is	42.0 cu cm.

The permanganate number of the coal is therefore 42.0.

A number of tests were made of different coals that were used in the gas works, and the results of some of these tests are given in the following:

Discussion of Results

From the above results it may be seen that the samples of coal, numbered from one to six, are good, normal coals which can be stored. When calculated

on the ash-free and moisture-free basis, all these coals show a bromine number in the neighborhood of 1300 and a permanganate number of about 50. On the other hand, samples 7 and 8 represent coals which weather easily in the presence of moist air, but which do not exhibit any increase in temperature. In the case of sample number 7, taken from a depth of one meter in the pile, both the permanganate number and the bromine number show marked differences from those that pertain to the good storage coals. In the case of the sample of coal that was taken directly from the outside of the pile of coal, a marked difference in the behavior of the coal is noted. In the first place the ash content increases from 7.6 to 35 per cent and the bromine number from 1340 to 1552 and the permanganate number from 46 to 64.4.

No.	Kind of coal	Per cent hygroscopic moisture	Ash per cent	Per cent sulphur	Original coal, air dry		Calculated on ash free and water free coal		
					Permanganate No.	Bromine No.	Permanganate No.	Bromine No.	
1.	Fairmont	1.1	9.4	0.85	45.5	1216	50.8	1359	Good storage coal
2.	Fairmont	..	..	...	40.3	1280	...	....	
3.	Holmside	0.4	7.6	1.54	46.1	1238	50.1	1346	
4.	Saar	1.6	5.1	...	45.6	1206	48.9	1293	
5.	Saar	0.8	4.9	1.56	46.2	1178	49.0	1249	
6.	Saar	0.5	3.9	0.70	44.9	1222	47.1	1281	
7.	American coal stored since 1919, sample from one meter depth	1.0	7.6	1.89	42.0	1225	46.0	1340	Coal that weathers
8.	American coal stored since 1919, surface coal	2.1	35.0	2.57	40.5	976	64.4	1552	
9.	English coal, cold, dull	1.0	4.4	1.14	22.0	694	23.3	734	Coal that burns spontaneously
10.	English coal, cold, lustrous	1.2	7.8	2.04	32.5	912	35.7	1002	
11.	English coal, 283 deg. C. hot	0.5	29.0	2.37	26.7	979	37.9	1389	

Dangerous Spontaneous Combustible Coals

Dangerous spontaneously combustible coals are represented by samples 9, 10 and 11. These coal samples were taken from cold as well as warm places in the coal pile. The cold, dull sample of coal is the original of the three. This is sample number 9. This coal has not yet been subjected to spontaneous decomposition and burning. This coal has the normal low moisture content of 1 per cent and a low ash content of 4.4 per cent. However, the fact that this coal possesses the power to burn spontaneously is seen from the low permanganate and bromine numbers. The permanganate number of 23.3, while that of normal coal is 50 and the bromine number is 734, while that of normal coal is 1300.

Sample 11 represents a coal which has been subjected to partial decomposition and spontaneous heating as the temperature of the coal had risen to 283 degrees C. Hence a partial burning of the coal has taken place, with the result that the ash content has risen from 4.4 to 29 per cent. Similarly the permanganate number rose from 23.3 to 37.9 and the bromine number from 734 to 1389.

The lustrous cold sample, sample number 10, is somewhat less liable to spontaneous decomposition than sample number 9. It has a correspondingly higher permanganate number, 35.7, and a bromine number, 1002.

Summary

The results may therefore be summarized as follows:

1. Good normal coal that can be stored will possess:

A bromine number of about..... 1300
A permanganate number of about..... 560
An ash content of.....4 to 9%

2. Cold weathering coal will possess:

(a) Before weathering—

A bromine number of about..... 1340
A permanganate number of about.. 46
An ash content of..... 7.6%

(b) During weathering—

A bromine number of.....1550 and higher
A permanganate number of.. 64 and higher
An ash content of.....35% and higher

3. Dangerous spontaneously combustible coal will possess:

(a) Before the commencement of the reaction (original condition)—

A bromine number of .....734 to 1000
A permanganate number of.....23 to 36
An ash content of.....4 to 8%

(b) After start of the reaction, 283 degrees C.—

A bromine number of..1390, perhaps higher
A permanganate No. of..38, perhaps higher
An ash content of.....29%, perhaps higher

It is thus evident that it is impossible to determine whether or not a coal will weather in the cold by means of the permanganate and the bromine numbers, but, on the other hand, it is possible to ascertain definite that a coal will be subject to spontaneous combustion on storage for a long time by making a careful determination of these factors.

LET'S GET DOWN TO BUSINESS

(Continued from page 158)

duce 433.5 pounds of steel in eight hours, while the gas furnace required 2,610 cubic feet of gas to produce 637.5 pounds of steel, or, in other words, 11.7 cubic feet of gas were the equivalent of 1 KWH. It is also of interest to note that the production of the gas furnace exceeded the electric by 30 per cent.

Basis of Charts

It must be remembered, however, that the theoretical value given in charts Nos. 1 to 4 inclusive, and the practical results quoted, are based on furnaces equal in design, construction and efficiency to the electric furnace. It is important to note that in the majority of cases an electric furnace will surpass the average cheap, uninsulated box that the gas industry has only too frequently sold as a furnace.

The Path of Least Resistance

In the past history of the industrial gas business, a tremendous amount of time, money and energy has

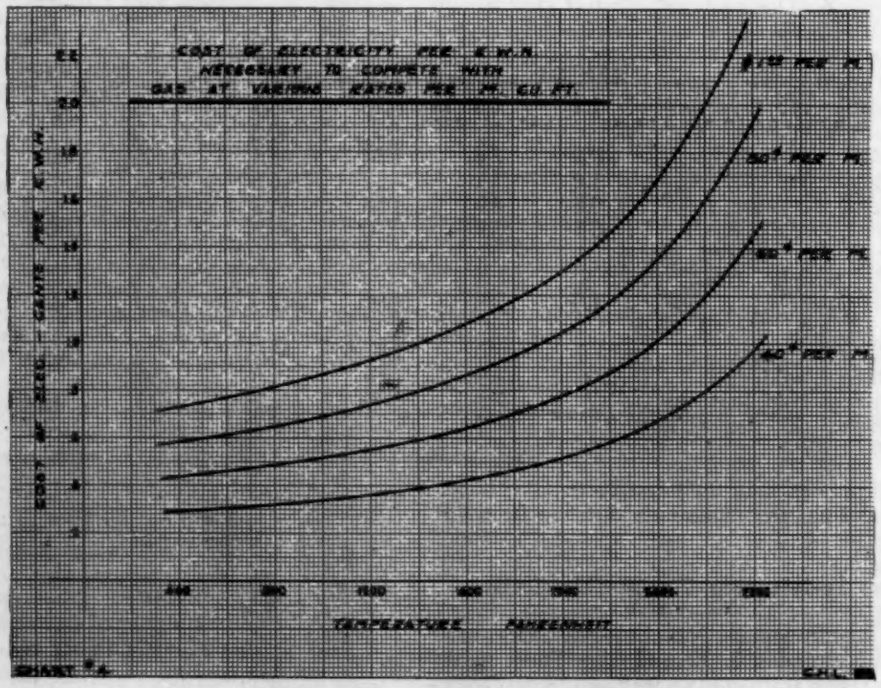


Fig. 4—Cost of Gas and Electricity

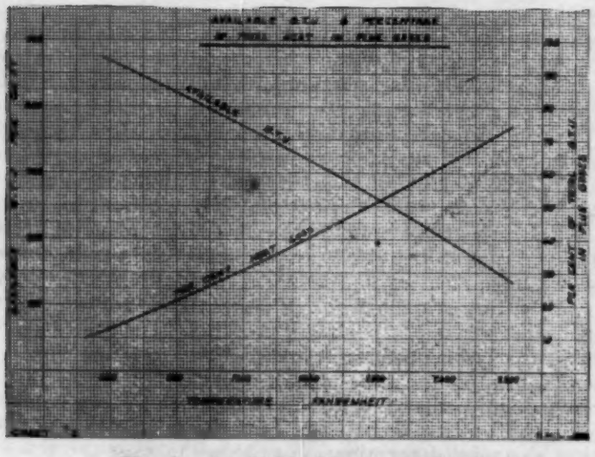


Fig. 2—Available Heat and Losses

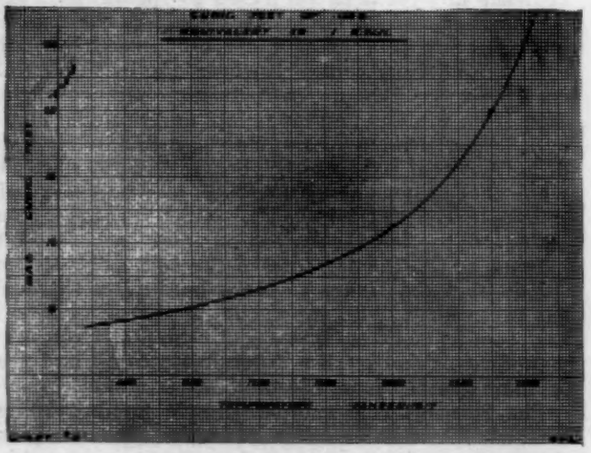


Fig. 3—Cubic Feet of Gas Equivalent to 1 KWH

been spent in educating the manufacturers to the point where they will appreciate the advantages to be gained in using gas in preference to the crude fuels. The results of this part of our work are a source of enthusiasm to all, but the deplorable part of the story is that, after having educated him, we take the path of least resistance and sell equipment, not on the basis of the best possible for the job, but because it happens to be the cheapest from the standpoint of initial investment.

The gas customer thus obtained offers a fertile field to the electric sales engineer. He is usually a good engineer, and, what is just as important, a "darn" good salesman. He is selling equipment with all the potential advantages of gas. The fact that he consistently competes with and displaces gas equipment with electric equipment selling at three times its cost speaks well of his ability.

The Future

The manufacturers of industrial gas equipment and the gas companies can study with great advantage the methods of the electric man and utilize similar means of propagating our industry. All our pride in our product or our knowledge of its desirability as the logical fuel for industrial heating is unavailing unless we mobilize all of our forces to offset the the formidable attack of the electric competitor. The utilization of electricity for industrial heating is unalterably opposed to the economic conservation of fuel.

The gas company that fails to realize the tremendous strides that the electric man is making in industrial heating is going to wake up some day and find that the most advantageous part of their load is missing.

Competition

In competition with any electric furnace using heating elements, a well designed and properly constructed gas furnace will always have the advantage from the standpoint of production, due to higher thermal head; automatic temperature control can be duplicated and uniformity of temperature is purely a matter of design. It is the exception to find a gas installation incorporating these characteristics, together with the efficiency of the electric furnace.

Industrial Gas Research Foundation

Unquestionably the gas industry must develop and sell better furnaces. The writer strongly advocates the immediate formation of an "Industrial Gas Research Foundation" to develop and prescribe definite recommendations and specifications for furnace construction.

To be successful it must have the unstinted support of every gas company. . . . Possibly by contributions based on their yearly sendout. Closer cooperation with the equipment manufacturers must be encouraged and their support obtained on some equitable factor.

It is possible that manufacturers contributing to the upkeep of this work would receive advance information as the work progressed. Eventually, however, all information must be broadcast nationally, as it is only by a liberal policy of keeping the public thoroughly informed of such progress that the highest degree of useful utilization can be attained.

MARKED IMPROVEMENT INDICATED

(Continued from page 160)

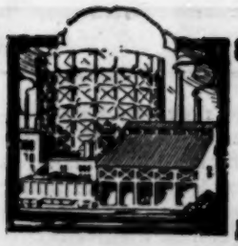
lowing the war our manufacturers have attempted to bring about a more satisfactory balance between manufacturing cost and wholesale prices. Wages were climbing rapidly and so was the cost of most raw materials, while the sluggishness of the retail market continued to have a depressing influence upon retail prices. Now the buyers' strike apparently has come to an end. Perhaps the consumer has exhausted his last reserves of merchandise and has been compelled to enter the market again. His view of what constitutes an attractive price has perhaps undergone a change. Whatever the cause, there exists the inclination to pay better prices, which has been readily utilized by manufacturers and dealers alike for the purpose of establishing a better margin between cost and sales price.

Such a condition is an exceedingly pleasing one. It is in fact so satisfactory that it is necessary to caution against overdoing a good thing. By one means or another the consumer has been again coaxed in the market. It is absolutely necessary now that his custom should be preserved and that he should not again be frightened by excessive prices into his former attitude of abstention from buying. This is the most necessary, as there are indications of a slight decline in the purchasing power of the consumer, caused by a steady rise of food prices which is not sufficiently counterbalanced by a similar increase in earning power.

Forced Sales

Another feature which should be guarded against is the throwing upon the market of merchandise at exceedingly low prices, caused by enforced sales of manufacturers' stock left over from the last season or the result of forced sales to obtain cash.

It is this aspect of the present situation which will require careful and circumspect attention during the next months, before the start of the spring season. The economic expansion following the war was accompanied by a general rise in the standards of living. We have accustomed ourselves to many luxuries, the enjoyment of which has materially added to the personal overhead, and which we now are loath to give up when earnings have decreased. Hence most of us have lived upon a more costly plan during the last year than we were really entitled to. The money has come out of the income from business and industry and a larger share has been withdrawn from the nation's working capital than has been good for the solidity of the financial structure.



NEWS OF THE GAS INDUSTRY

Gas Section, Wisconsin Utilities, to Meet

The Gas Section is holding its annual section convention this year at Stevens Point. The time is February 26 and 27; the place of meeting, Hotel Whiting, Stevens Point. Our hosts, the Wisconsin Valley Electric Company, through Harold L. Geisse, general manager, and M. H. Montross, successor to Mr. Sikes, are making local arrangements, and we are sure of a royal welcome and a splendid meeting. The following program of this convention should vitally interest all who are interested in any phase of the gas industry. We feel that the committee is offering a splendid group of subjects and a very fine list of speakers.

Thursday, February 26, 10 a. m.

Address of welcome—Mayor John N. Welsby.

Chairman's address—Mr. J. G. Felton, Northern States Power Company, La Crosse.

Interesting Side-Lights on Household Refrigeration — Prof. O. L. Kowalke, University of Wisconsin.

Recent Developments in Liquid Purification—Mr. S. B. Sherman, Wisconsin Gas & Electric Company, Racine.

Thursday, February 26, 1:30 p. m.

Importance of the Accuracy of Instruments—Mr. R. L. Rundorff, Northern States Power Company, Minneapolis.

Problems Arising in Connection with Erection of Holders and Putting Them Into Service—Mr. A. F. Davey, Wisconsin Public Service Corporation, Sheboygan; Mr. George E. Wagner, Madison Gas & Electric Company, Madison; Mr. Bruno Rahn, Milwaukee Gas Light Company, Milwaukee.

General discussion—Employees' Activities and Organizations—Opened by Mr. George H. Wilmarth, Northern States Power Company, Eau Claire.

Report of nominating committee.

Election of chairman and vice-chairman.

4:00 p. m.—Inspection trip to gas plant and other points of interest.

Annual Dinner of the Section

6:30 p. m.—Hotel Whiting.

Address—What the Housewife Expects and Receives in the Way of Gas Service—Miss Bessie Mae Allen, director of Home Economics Department, Stevens Point Normal School.

Address—Present Problems of the Gas Industry—Major Alexander Forward, secretary-manager, American Gas Association.

Dancing.

Friday, February 27, 9:30 a. m.

What Effect Will Reinforced Concrete Pavement Have Upon the Location of Mains—Mr. I. F. Wortendyke, New Gas Light Company, Janesville.

What I Found Out About Welding Steel Mains—Mr. Louis Stein, Northern States Power Company, Minneapolis.

General discussion.

Round Table discussion of Operating Problems — Gummy Deposits in Meters; The district service man who handles meter reading, appliance adjustment, commercial work, etc.

Demonstration in First Aid—First Aid Drill Team—Wisconsin Public Service Corporation, Oshkosh.

1:30 p. m.—Trip through Whiting-Plover Paper Mill.

Westchester Lighting Co. Increases Capitalization

Albany, N. Y. — Westchester Lighting Company, Port Chester, N. Y., through Shearman & Sterling, attorneys, 55 Wall street, New York City, has filed a certificate in the office of the Secretary of State increasing its number of shares and reclassifying its stock issue from a capital of $12,500,000, consisting of 25,000 shares preferred stock, $100 par value, and 100,000 shares common stock, $100 par value, to 384,000 shares, of which 100,000 shares are common and 25,000 shares second preferred stock, both of $100 par value.

Unpaid Gas Bills to Be a Lien on Real Property

Albany, N. Y.—An important amendment to the village law, adding new section 360, giving municipal gas plants a lien on real property on which gas was used, for all unpaid bills, was introduced in the Assembly by Edmund F. Cooke of Alden, representing the Seventh District, Erie County. The outcome of this measure will be of much interest to gas and electrical corporations, as well as to consumers and landlords of apartment and tenement houses. Should this measure become a law, the next logical step would be the enactment of a state-wide statute of similar nature affecting all private corporations.

Fulton Gas Co. Increases Capital Stock

Albany, N. Y.—A certificate has been filed in the office of the Secretary of State at Albany, through L. C. Smith, attorney, 18 East Fulton street, Gloversville, increasing the capital stock of the Fulton County Gas and Electric Company, Gloversville, from $1,732,600 to $2,157,600.

Catskill Power Corp. Chartered

Albany, N. Y.—Catskill Power Corporation, Middletown, N. Y., has been chartered at Albany with a capital of 40,000 shares non-par value, to supply electricity or gas. Charles H. Tenney, Springfield, Mass., Edward M. Bradley, New Haven, Conn., and Alex. S. Burns, Jr., Spring Valley, N. Y., are the directors and subscribers. E. H. Beals, 1429 Marine Trust building, Buffalo, N. Y., is attorney for the corporation.

Crystal City Gas Rate Fixed

Albany, N. Y. — The Public Service Commission has issued an order fixing a rate of 93 cents per thousand cubic feet to be charged for natural gas by the Crystal City Gas Company of Corning, instead of the $1 rate which the company asked permission to charge. The new rate provides for a reduction of 5 cents per thousand cubic feet for prompt payment, and the company is authorized to put it into effect on one day's notice.

When the Potter Gas Company of Pennsylvania, from which the Crystal City company buys its entire supply, increased its price for the gas, the Crystal City company petitioned the commission for authority to increase its rate to consumers from 80 cents to $1 per thousand cubic feet. The commission has disallowed the full increase sought, holding that the increase allowed was sufficient to yield an 8 per cent return on a rate base fixed at $150,000. The case was heard by Commissioner George R. Van Namee.

The company contended that it should be allowed to set aside annually a large amount for depreciation, because of the assumed fact that the available supply of natural gas will be substantially exhausted at the end of the next ten years. The commission held that the franchises would permit the company to manufacture gas and that should the supply of natural gas be exhausted within ten years the company's plant would not be reduced to scrap value, but would be available for use if the company constructed a generator, gas holder and such other property as might be necessary to enable it to manufacture gas.

U. G. I. Gets Government Contract

The U. G. I. Contracting Company of Philadelphia has signed a contract with the United States Government for the construction of Lock No. 51 on the Ohio River near Galconda, Ill. The price exceeds $1,000,000. Preliminary work will begin in March and it is expected that the lock will be completed by December 31, 1926. About 350 men, including a corps of engineers from Philadelphia, will be employed. A camp will be built for the working force.

Gas Meter Men to Meet at Purdue University

A conference for gas metermen will be held February 23-25, inclusive, at Purdue University, under the direction of the School of Chemical Engineering, in co-operation with the Indiana Gas Association.

The program of the meeting will be as follows:

Monday, February 23

(Forenoon)

10:00 a. m. to 12:00 A. M.—Registration and get acquainted meeting. Inspection of shops and laboratories.

12:00 Noon—Lunch. Memorial Union or Home Economics Cafeteria.

(Afternoon)

1:00 p. m.—Opening session: Address of Welcome, A. A. Potter, Dean of Schools and Engineering. General Announcements; H. C. Peffer, head of School of Chemical Engineering.

1:45 p. m.—First Lecture and demonstration, covering Tin Meter Repairs: Installation, Care of Prover, Proof Test of Meter from Service and Classification of Repairs, Care and Dressing of Soldering Iron, Removing Top of Meter and Tinning Part—Geo. A. Lane, superintendent of meters, Peoples Gas, Light and Coke Company, Chicago, Ill., assisted by William Rosenia and Frank Kepschull.

2:45 p. m.—Shop Practice, covering work outlined in lecture.

5:00 p. m.—Adjournment.

(No evening session).

Tuesday, February 24

(Forenoon)

8:15 a. m.—Care of Meters. Mr. F. W. Sargent, superintendent of distribution, Citizens Gas Company of Indianapolis, Indianapolis, Ind. Discussion, Mr. A. T. Bar- American Meter Company, Chicago, Ill.

9:15 a. m.—Second lecture and demonstration, Mr. Geo. A. Lane and assistants:, covering Tin Meters: Remove Back Plate, Valves, Horizontal Axle and Index, Oil Diaphragms, Wash Gallery, Grind Valves, Test Valve Arms for Lost Motion and Correct, Test Division of Valve Arms and Correct, Replace Back Plate, Repack Stuffing Box, Replace Horizontal Axis and Index, Test for Binding, Test Division of Flag Arms and Correct.

10:30 a. m.—Shop Practice.

12:00 noon—Lunch.

(Afternoon)

1:00 p. m.—Lecture and demonstration, covering Iron Case Meters, Design, Construction, Operation, Proving, Adjusting and Repair—Mr. E. C. Falvey, Sprague Meter Company, Davenport, Iowa, assisted by Mr. H. R. Pierce.

2:00 p. m.—Third lecture and demonstration, Mr. Geo. A. Lane and assistants, covering Tin Meters: External Pressure Test, Slow Motion Test and Four Pointing, Adjusting, Putting on Top, Pressure Test on Top.

3:00 p. m.—Shop Practice on preceding lecture.

5:00 p. m.—Adjournment.

(Evening)

6:00 p. m.—Dinner, Memorial Union building. Illustrated lecture, "Innocence Abroad," Professor A. G. Phillips, Purdue University.

Wednesday, February 25

(Forenoon)

8:30 a. m.—Fourth lecture and demonstration, Mr. Geo. A. Lane and assistants, covering Tin Meters: Remove Front and Back, Remove Diaphragm, Boil Case and Parts, Inspect, Special Repairs, Tin Case and Parts, Test for Channel Leaks, Put in Diaphragm and Discs, Test Diaphragms, Replace Front and Back.

9:30 a. m.—Shop Practice.

(Afternoon)

1:00 p. m.—First Aid and Resuscitation, Mr. S. H. Reid, Bureau of Safety, Chicago, Ill.

2:00 p. m.—Shop Practice (A) Tin Meters, (B) Iron Covered Meters. General questions, etc.

Unclaimed Deposits Legislation in Albany

Albany, N. Y.—Under the provisions of a bill introduced in the Assembly by Mr. Reidy of The Bronx, a new section, 63-A, is added to the transportation corporation law, requiring turning over to the state comptroller of deposits received by gas and electric light companies remaining unclaimed for five years after gas or electricity has been cut off, and if unclaimed by owners for a further five years to be paid into the general fund of the state treasury.

Service Charge Bill in New York Legislature

Albany, N. Y.—Walter S. Gedney, Republican and lawyer of Nyack, representing Rockland County, has introduced in the Assembly a bill adding a new section, 42, to Public Service Commission law, providing no corporation under jurisdiction of the commission shall collect a charge for service in advance or for installation of apparatus or use of installed apparatus.

Empire State Gas Co. Rates Approved

Albany, N. Y.—The Public Service Commission has approved schedule of the Empire Gas and Electric Company for gas service supplied to the village of Clifton Springs, N. Y., new territory served as follows, for light, heat and fuel service: First 100 cu. ft., 50 cents; next 19,900 cu. ft., 13.5 cents per M. cu. ft.; next 80,000 cu. ft., 9 cents per M. cu. ft.; next 900,000 cu. ft., 8.5 cents per M. cu. ft.; next 1,000,000 cu. ft., 8c per M. cu. ft.; all over 2,000,000 cu. ft. per month, 7.5 cents per M. cu. ft. Minimum charge, 50 cents per meter per month. Bills will be rendered with 10 per cent added where bills are $30 or less, plus 2 per cent for all over $30, to be discounted to rate if paid on or before the tenth day following the date of rendition, providing all arrearages at that time are paid.

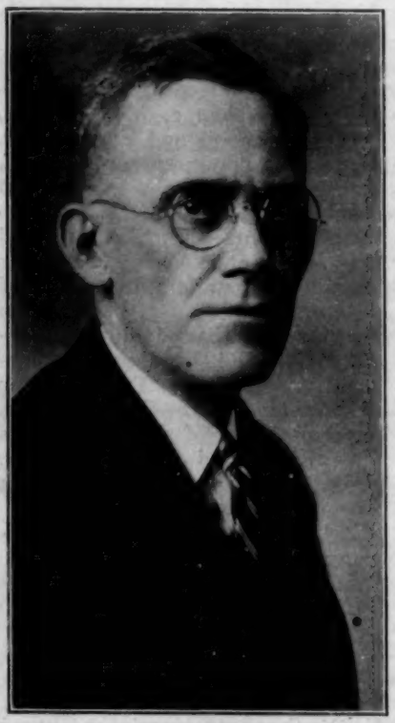
Farewell Banquet Tendered Jesse Stetser

On Friday evening, February 5, fellow employees gave a farewell banquet in honor of Jesse Stetser, upon his leaving the Welsbach Company, after 25 years of service, to join the Roberts & Mander Stove Company of Philadelphia, manufacturers of the well known line of Quality gas ranges and appliances.

After enjoying excellent orchestra music and vaudeville entertainment from Philadelphia, a handsome traveling bag was presented to Mr. Stetser by Mr. Knoedler, on behalf of the factory representatives. Iden Lenton, secretary to the president, prepared and read the following Limerick, which was hailed as the hit of the occasion:

When you sing to the praise of
Jess Stetser,
You've got a good subject, you bet,
Sir.
He's a joy and delight
And does everything right
And his equal you'll find hard to
get, Sir.

But the Welsbach is parting with
Stetser,
The best little fixer we've met,
Sir;
And we hope we'll all meet
Where he has a front seat
In the land where the sun never
sets, Sir.



Jesse Stetser

Changes in Augusta Gas Company Organization

M. M. May, who for the past 18 years has been head bookkeeper with the Augusta Gas Company, will succeed F. L. Marshall as manager. Mr. May is a native of Augusta and is well and favorably known there.

W. Fred Eve, Jr., has been made commercial manager for the company, Patrick J. Gould shop foreman and R. N. Neighouse superintendent of distribution, as well as superintendent of works.

Miss Cephalie Lewis is director of the Home Service department.

Continental Gas Control Is Sold to United Light

Control of the Continental Gas and Electric Company, according to reports from Omaha, has been sold to the United Light and Power Company of Chicago. Rufus E. Lee, president of the Continental, has announced his resignation, effective March 1. The general offices of the company are expected to be moved from Omaha to Lincoln. Richard Schadelles of Chicago, vice-president of the United, will succeed Mr. Lee as head of the Continental.

The Continental company recently purchased the Kansas City Power and Light Company and the Columbus Power and Light Company. It also controls the Marysville Electric Company and the Lincoln Gas and Electric Light Company.

W. A. Learned Passes Away

Waldo R. Learned, vice-president of the Boston Consolidated Gas Company, and former president of the Newton and Watertown Gas Light Company, passed away suddenly on January 6, at 11 o'clock, after being actively engaged in business at the office that afternoon.

Mr. Learned was 70 years old, having been born at Watertown, Mass., on October 20, 1854. He was associated with the Newton and Watertown Gas Light Company and the Boston Consolidated Gas Company for 43 years. He was well known among gas men in the East and was a member of the Guild of Gas Managers, the American Gas Association, the N. E. Association of Gas Engineers and the Engineers Club of Boston.

Mr. Learned leaves a wife and two daughters.